A Proactive Approach to Growth
Texas A&M Utility Master Planning Update

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CampusEnergy2018: SHARING SOLUTIONS, SUSTAINING OUR FUTURE
March 5-9, 2018
TEXAS A&M UNIVERSITY OVERVIEW

5,200 acres; 800+ buildings; 30 million GSF served
4 million GSF added since 2016
Over 68,500 students with 11,000 faculty and staff
Seven utility plants - CUP, SUP1, SUP2, SUP3, RELLIS, HSC, MCB

Utility Plant Capacities:

• 50 MW power generation
  ► 34 MW gas turbine
  ► 16 MW with two steam turbines
• 65,000 tons of cooling (both electric & steam)
• 440,000 pph of steam
• 600 million Btu/hr of heating hot water
# INTRODUCTION TO TAMU UES

## PROCUREMENT
- Calculate and nominate campus electricity & NG requirements
- Specify annual and monthly consumption quantities
- Review and recommend payment of invoices
- Serve on TAMU energy procurement and risk management committee

## TRANSMISSION
- **TAMU owns:**
  - Domestic water transmission system
- **Atmos owns:**
  - HP (600 psi) NG transmission system to CHP facility
- **BTU owns:**
  - 138kV electrical transmission system (ERCOT)
- **Supply coordination**
  - Atmos
  - BTU
  - ERCOT

## PRODUCTION
- **Management of:**
  - Four campus utility plants
  - Moore Connally Building utility plant
  - Health Science Center utility plant
  - RELLIS utility plant
  - Solid Waste & Recycling Services
  - 2 wastewater treatment facilities
  - Domestic water systems
- **Production of:**
  - Electricity
  - Chilled Water (for cooling)
  - Hot Water (for heating)
  - Domestic Water (hot & cold)
  - Steam

## DISTRIBUTION
- **TAMU owns and operates campus delivery systems:**
  - 12.5kV Electrical
  - Domestic Water (hot & cold)
  - Chilled Water
  - Heating Hot Water
  - Steam
  - Sanitary Sewer
  - Storm Drainage
- **HSC Campus (Bryan)**
- **RELLIS Campus**
- **Atmos owns:**
  - LP & IP natural gas distribution systems
- **2,500+ revenue-quality meters in over 500 buildings**
- **Manage utility rate model and rate setting**
- **Manage customer invoicing and utility cost recovery**
  - Operating budget
  - Capital upgrades
  - Purchased energy

## METERING & BILLING
- Building automation and HVAC operation
- First response to ensure customer comfort and environmental control
- Energy Stewardship
- Energy Performance Improvement (EPI)
- Energy management services
- Design review and capital project coordination
- Customer requests thru AggieWorks Center
- Capital renewal and upgrade

## DEMAND-SIDE MANAGEMENT

BURNS MCDONNELL

4
60 percent increase in campus square footage with 20 percent decrease in energy consumption projected thru FY20.
Over $230 million cost avoidance realized thru FY17

Over 47 percent energy consumption reduction per GSF through FY17

Source EUI based on total “onsite and offsite” energy consumption

Site EUI based on energy consumption in campus buildings

Goal is to reduce source EUI an additional 5% through FY20

Source EUI

Site EUI

Actual

Projected
UTILITY AND ENERGY INITIATIVES

- Comprehensive Building Utility Metering
- Combined Heat and Power (CHP)
- Energy Consumption Reductions - $30 million invested over six years
- Energy Stewardship Program
- Energy Performance Improvement (EPI) Program
- Energy Action Plan (EAP) 2020
- Chilled Water Optimization Program
- Utilities & Energy Design Standards
- Utilities & Energy Master Planning
- Utility Infrastructure Capital Investment
UTILITY MASTER PLANNING

Primary Issues Addressed in 2017 UMP

• Capacity
• Reliability
• Future Load Growth
• Demand Side Management
• Design Standards
• GHG Emissions
MASTER PLANNING BENEFITS

Why another Utility Master Plan?

• Significant campus expansion
• Aging equipment/systems required upgrades
• Desire to expand scope of proven ECRMs

Delayed Savings are **LOST** Savings
**MASTER PLANNING STEPS – OUR PROCESS**

**Streamlined** Master Planning Approach

- 2012 UMP vs 2018 UMP
- Match load projections to Campus Master Plan
  - Engagement of all stakeholders from the start
- Worked very closely with UES staff and management
- Design Standards – captured “Tribal Knowledge”
- Focused on thoughtful capacity additions
  - **Load/Duration Curve was key to success!**

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**BURNS MCDONNELL**
MASTER PLAN RESULTS

Key Growth Areas by 2037

• Chilled Water
  ➤ 40% on East Campus, 98% on West Campus
• Heating Water
  ➤ 32% on East Campus, 100% on West Campus
• Domestic Hot Water
  ➤ Little to no growth in central production & distribution
• Electrical
  ➤ 70% overall
MAJOR PROJECTS AND UPGRADES

$226 million in projects identified by 2037 (FY17 dollars)

► Two Satellite Utility Plant Expansions
► New Satellite Utility Plant Construction
► Additional Heat Recovery Chiller Capacity
► Consolidation of UES personnel in a new building
► Minimization of centralized process steam
► Aggressive Demand Side Management Program
► Upgrades based on age, condition, and capacity
<table>
<thead>
<tr>
<th>DESCRIPTION</th>
<th>LOCATION</th>
<th>SYSTEM</th>
<th>REPLACEMENT TYPE</th>
<th>COST (FY17 DOLLARS)</th>
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**FY18-FY22 TOTALS** | | | | **$72,002,000** | **$79,589,000** |
STEAM SYSTEM EVALUATION

Site Investigation

• General Condition
• Tunnel Structure
• Piping Supports
• Pipe Condition
• Efficiency/Safety

Load Analysis

Options Evaluated

• Continued Distribution
• Local Boiler Generation
• Equipment Upgrades/Retrofits
• $\sim 200k$ cost avoided
DEMAND SIDE MANAGEMENT– HEAT RECOVERY

Opportunity: Historical failure and improper design of exhaust air Heat Recovery

Recommendation: Design and operate the most efficient, maintainable, commercially available system for the appropriate air classifications.
DEMAND SIDE MANAGEMENT– LABS

Opportunity: Increase energy efficiency in laboratories and 1,712 fume hoods on campus.
Recommendation: Strategically invest in the right kinds of labs, and in the right order.

Lab Incremental Opportunities

<table>
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<tr>
<th>Case</th>
<th>Description</th>
<th>Relative Capital Investment</th>
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<tr>
<td>Case 1</td>
<td>Baseline - Constant Air Volume (CAV) Supply, Exhaust, and Hoods</td>
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<tr>
<td>Case 2</td>
<td>VAV Supply, CAV Hoods</td>
<td>$$$</td>
</tr>
<tr>
<td>Case 3</td>
<td>VAV Hoods and Supply</td>
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<td>Case 4</td>
<td>Minimum hood airflows to ANSI Z9.5. Unocc sash position lowered to 20%</td>
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</tr>
<tr>
<td>Case 5</td>
<td>Minimum room airflow setpoints to 8 ACH when occupied</td>
<td>$</td>
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<tr>
<td>Case 6</td>
<td>Add room occ sensors, minimum airflow setpoints at 4 ACH when unoccupied</td>
<td>$$</td>
</tr>
<tr>
<td>Case 7</td>
<td>Add air-side heat recovery, run-around coils</td>
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<tr>
<td>Case 8</td>
<td>Fume hood zone presence sensors, with unocc face velocity = 60 fpm</td>
<td>$$</td>
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<tr>
<td>Case 9</td>
<td>Automatic sash closers. Unocc sash position = 0%</td>
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<tr>
<td>Case 10</td>
<td>Demand-based ventilation. ACH 4/2</td>
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</table>

Energy Savings Potential

- Case 1: No change - CAV hoods still drive flow
- Case 2: VAV hoods result in average 8.32 ACH
- Case 3: No significant change
- Case 4: Small change in airflow due to lower hood minimums
- Case 5: Airflows already at minimum for changes proposed
- Case 6: Unoccupied ACH from 8 to 4, ACH now drives airflow
- Case 7: At low average airflow, heat recovery has small effect
- Case 8: Negligible because of already low minimum hood flows
- Case 9: Negligible because of already low hood flows
- Case 10: Small change because cooling now drives airflow
**DEMAND SIDE MANAGEMENT– OTHER OPPORTUNITIES**

**Opportunity:** Continue utilizing technology, people, and programs to reduce energy use

**Recommendation:** Build on the success of past programs to enable further energy reduction to offset campus load growth.

- Look at DSM investments as “utility system assets”
- Replace obsolete and limiting controls components to prevent loss of functionality and data
- Integrate best available technologies and programming into the controls replacements, to realize a return on the larger investment.
- Investigate the potential of FDD software complimenting existing real-time monitoring
ENERGY AND GHG SAVINGS

Key Features of Plan

• Over 2/3 of the total emissions (298,550 MTCDE) related to energy
• GHG output from existing buildings - **reduce by 1.5% annually**
• GHG output from new buildings – **reduce by 1% annually**
• Campus carbon output associated with energy consumption will be **reduced by approximately 20%** when compared to a baseline of current carbon intensity
**NEXT STEPS**

Communicate and Sell the Plan!
- Utilities & Energy Services, Finance, Administration, Campus Community

Implement Strategic Plan
- Near-term projects are first priority

Adjust Plans and Priorities as appropriate
- UMPs must be kept current and relevant
- Update UMP every five years